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Indian Standard

GUIDANCE FOR ENVIRONMENTAL TESTING

PART 18 ULTRASONIC CLEANING TEST

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GUIDANCE FOR ENVIRONMENTAL TESTING

PART 18 ULTRASONIC CLEANING TEST

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*For the meeting in which this standard was recommended for finalization.

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GUIDANCE FOR ENVIRONMENTAL TESTING

PART 18 ULTRASONIC CLEANING TEST

0. FOREWORD

0.1 This Indian Standard (Part 18) was adopted by the Indian Standards Institution on 27 June 1986, after the draft finalized by the Environmental Testing Procedures Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

0.2 This standard (Part 18) provides detailed guidance for ultrasonic cleaning test. The test procedure is covered in IS : 9000 (Part 27)-1986*.

0.3 This standard is based on IEC Publication 653(1979) 'General considerations on ultrasonic cleaning', issued by the International Electrotechnical Commission (IEC).

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960†. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard (Part 18) covers guidance as well as general considerations on ultrasonic cleaning exposure of electronic and electrical items.

2. PROBLEMS ARISING FROM ULTRASONIC CLEANING

2.1 Causes of Deterioration

2.1.1 *Surface Finish and Markings* — It is taken as minimum level of cavitation at which deterioration may occur in solvents which are harmless as long as no ultrasonic energy is applied.

*Basic environmental testing procedures for electronic and electrical items: Part 27 Ultrasonic cleaning test.

†Rules for rounding off numerical values (*revised*).

2.1.2 *Deterioration of Material, Leads and Bondings* — It is assumed that these faults are due to resonances. Most experiments have found that cleaning at 40 kHz is less damaging to delicate components, such as, point contact semiconductor devices, than cleaning at 25 kHz. However, some reports have stated that there is no difference and one case of the reverse situation has also been reported. When there is a type of component which is or parts of which are in resonance at a test (or cleaning) frequency, the question of the limits over which the resonance frequency may vary when a great number of items of this type are tested shall be examined.

2.2 Test Equipment — It seems to be self-evident that a test should be carried out at discrete frequencies (25 kHz or 40 kHz) with narrow tolerances. This would require uniformity of test equipment, including the dimensions of the tank and the volume of liquid.

2.2.1 However, most modern self-tuning ultrasonic generators seek the optimum operating frequency for any load presented to them. This makes very close tolerancing of the test frequency both difficult and unrealistic. Commercially available generator/transducer sets of identical design will show a spread of some $\pm$ 10 percent around the nominal operating frequency. This frequency will also be dependent on temperature and depth of liquid, and on the load in the bath.

3. FURTHER INVESTIGATIONS TO BE MADE

3.1 It is known that output power is related to sound pressure level. However, values of sound pressure level are not yet available for this application.

3.2 Definition of Sound Pressure — It seems likely that the peak value of the ultrasonic pressure is the determining factor in relation to damage to components, although this has still to be confirmed. Measurements of peak values have been made using an oscilloscope. A meter indication is desirable but there are difficulties with spurious peaks which could be avoided if an rms meter was used. However, the results of some measurements did not give a constant relation between the peak and rms values.

3.3 Measurements at Different Temperatures — Sound pressure measurements have shown, in general, a rising tendency in relation to the temperature. In several cases, however, the sound pressure values measured at one or two values of a series of temperatures deviated greatly from the normal tendency. This observation was reproducible as long as the liquid was not changed. In another bath with a liquid of identical nature, deviations at different temperatures were observed.

3.4 There are two groups of questions to be answered, the first concerning the response of components to ultrasonic stress, the second concerning the methods and equipment. Some of the questions can only be answered by people who have extensive experience of ultrasonic cleaning.

3.5 The following problems remain to be solved:

a) To what extent is the sound pressure level significant when deterioration of surface finish and markings is considered,

b) What level of cavitation is admissible (possibly specified by sound pressure) when deterioration of surface finish and markings is considered,

c) Dependence of sound pressure on temperature of the bath (requires a series of time-consuming tests), and

d) Correlation between sound-pressure (peak and rms value) and cavitation level.

4. CONCLUSION

4.1 It shall be emphasized that the object of an ultrasonic cleaning exposure test is to determine whether the component or part to be cleaned with the aid of ultrasonic energy will withstand ultrasonic vibrations at any frequency applied by undefined coupling.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	$1 \ \mathrm{N} = 1 \ \mathrm{kg.m/s^2}$
Energy	joule	J	$1 \ \mathrm{J} = 1 \ \mathrm{N.m}$
Power	watt	W	$1 \ \mathrm{W} = 1 \ \mathrm{J/s}$
Flux	weber	Wb	$1 \ \mathrm{Wb} = 1 \ \mathrm{V.s}$
Flux density	tesla	T	$1 \ \mathrm{T} = 1 \ \mathrm{Wb/m^2}$
Frequency	hertz	Hz	$1 \ \mathrm{Hz} = 1 \ \mathrm{c/s} \ (\mathrm{s^{-1}})$
Electric conductance	siemens	S	$1 \ \mathrm{S} = 1 \ \mathrm{A/V}$
Electromotive force	volt	V	$1 \ \mathrm{V} = 1 \ \mathrm{W/A}$
Pressure, stress	pascal	Pa	$1 \ \mathrm{Pa} = 1 \ \mathrm{N/m^2}$